Module 5-2: Artifact Narrative (Databases)

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Computer Science Capstone

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October 6, 2024

For the capstone project of my bachelor's degree in computer science I had many artifact options to choose to enhance. To best show my skills and achieve the course outcomes I have chosen to enhance an Event Tracking Mobile Android application that I created for the Android operating system using Android Studio. The event tracking application artifact was created during CS-360, which was a previous class named Mobile Architecture and Design. This class was attended during the 2023-2024 school year at Southern New Hampshire University. The application that I created is designed to manage events for users of the application. The user can add, edit, track, and delete events, manage the details within the event, receive text alerts about the events, and track multiple events if needed. The narrative associated with this section of the project will focus on databases. The enhancing of the database, the skills associated with those enhancements, and the course outcomes achieved will all be discussed in the following sections.

The artifact that had the ability to showcase my coding and creative skills along with my ability to understand an assignment and follow instructions. The inclusion of the event tracking application in my ePortfolio allows me the ability to showcase my skills in software design and engineering, algorithms and data structures, and most recently databases. This narrative will focus on my skills in secure data handling techniques, the implementation of encryption methods, the security of the database, error handling within the database, and SMS text permissions for the user. I use a Database helper class for managing user credentials and events, this shows my skills in structured data handling. I used AES encryption for passwords in my SmsPermissionActivity and key management in KeystoreUtil. This encryption shows my skills in encryption methods and reaffirms my ability to securely handle data. I also provide error handling in SmsPermissionActivity by catching exceptions when generating encryption keys and encrypting passwords. I have also shown skills in database security by protecting data both at rest and in transit with my encryption methods. The artifact was enhanced by providing encryption to the application, securing the database, and adding a NextActivity class and xml layout file to ensure that when login is successful, the user will be taken to another page.

The course outcomes that have been provided for this capstone project have been thoughtfully included within my project. I have developed with the outcomes in mind and have met all these outcomes at different times of the project but have achieved all five of the outcomes across the totality of the application. The outcomes that are included in this section of the application, databases, have been met and consist of outcomes 3, 4, and 5. Outcomes three and four have been met in prior categories but outcomes five, develop a security mindset that anticipates adversarial exploits in software architecture and designs to expose potential vulnerabilities, mitigate design flaws, and ensure privacy and enhanced security of data and resources, has been added to this artifact. This section of the capstone has been thoroughly researched and enhancements have been thought out. Through encryption, secure data handling, error handling, and additional pages I have been able to improve the user experience and the performance and security of the application.

When performing the necessary changes to the artifact in the database category, I used many different skills to achieve my anticipated course outcomes. In the SmsPermissionActivity.java class I was able to use AES encryption to secure user passwords before storing or validating them. Using this type of encryption provides a tradeoff of a strong level of security and good performance. In the Database.java and EventAdapter.java classes I use SQLite and managing the users’ credentials and events. The tradeoff of SQLite is that it’s easy to use with Android but may not handle large sets of data. The use of these methods and the attention to security and performance of the database achieves outcomes 3 which states, design and evaluate computing solutions that solve a given problem using algorithmic principles and computer science practices and standards appropriate to its solution, while managing the trade-offs involved in design choices (data structures and algorithms). Course outcomes 4 is also achieved in this category which states, demonstrate an ability to use well-founded and innovative techniques, skills, and tools in computing practices for the purpose of implementing computer solutions that deliver value and accomplish industry-specific goals (software engineering/design/database). This is achieved through NextActivity.java and RegistrationActivity.java. I show an understanding of Android activity lifecycle with the use of BottomNavigationView and button animations. This enhances user engagement and feedback. I also provide secure data handling in Database.java class. This is done with a structured approach and secure queries. The only outcome that I have not achieved so far in the enhancements has been outcome 5. I have achieved outcome 5 in this category through different layers of secure operations. I used AES encryption and key management to secure sensitive data in the SmsPermissionActivity.java and KeystoreUtil.java classes. In the RegistrationActivity.java class I validate user input for username and password as a part of a secure mindset. In this category I was provide error handling and Unit and Integration testing to test these measures. By doing this I achieve outcome 5 which states, develop a security mindset that anticipates adversarial exploits in software architecture and designs to expose potential vulnerabilities, mitigate design flaws, and ensure privacy and enhanced security of data and resources.

As I worked on the artifact for the event tracking application, I have learning and have faced challenges. The category of databases that is being discussed in this narrative was an area in which I have had the least amount of experience. I have worked with MySQL and SQLite in the past but providing the proper layers of protection and performance together are something I have learned more to do this week. The performance and data handling of the database is something that can cause your application to not function or to function slowly and with security flaws that put the user at risk. I learned the subtle ways that encryption, sms permissions, and error handling can provide a more secure and robust application without the user knowing it is happening. This must all happen with limited interference to the user and without a tradeoff in performance. The challenge of authentication has been the biggest challenge of this artifact. There is still work that needs done on 2FA authentication and ensuring that users have the ability to accept or deny sms permissions.